DISSERTATION ON

PROSPECTIVE STUDY OF VARIOUS FACTORS INFLUENCING SURGICAL SITE INFECTIONS

M.S.DEGREE EXAMINATION
BRANCH – I
GENERAL SURGERY

THANJAVUR MEDICAL COLLEGE AND HOSPITAL

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY

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CERTIFICATE

This is to certify that dissertation entitled '**PROSPECTIVE STUDY OF VARIOUS FACTORS INFLUENCING SURGICAL SITE INFECTIONS** is a bonafide record of work done by **Dr.POOVENDRAN.T,** in the Department of General Surgery, Thanjavur Medical College, Thanjavur, during his Post Graduate Course from 2006-2009 under the guidance and supervision of **PROF. DR. T. KRISHNAMOORTHY, M.S.,** and **PROF. DR. G. AMBUJAM, M.S., F.I.C.S.,** This is submitted in partial fulfillment for the award of **M.S. DEGREE EXAMINATION- BRANCH I (GENERAL SURGERY)** to be held in March 2009 under the **Tamilnadu Dr. M.G.R. Medical University, Chennai.**

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DECLARATION

I declare that this dissertation entitled '**PROSPECTIVE STUDY OF VARIOUS FACTORS INFLUENCING SURGICAL SITE INFECTIONS** is a record of work done by me in the department of General Surgery, Thanjavur medical college, Thanjavur, during my Post Graduate Course from 2006-2009 under the guidance and supervision of my unit chief **PROF. DR. T.KRISHNAMOORTHY, M.S.,** and professor and head of the department **PROF. Dr. G. AMBUJAM, M.S., F.I.C.S.,** It is submitted in partial fulfillment for the award of **M.S. DEGREE EXAMINATION- BRANCH I (GENERAL SURGERY)** to be held in March 2009 under the **Tamilnadu Dr. M.G.R. Medical University, Chennai.** This record of work has not been submitted previously by me for the award of any degree or diploma from any other university.

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CONTENTS

1.INTRODUCTION

The importance of analysis of Surgical wound infection is manifold. Firstly, from the patients point of view there is prolongation of status of ill-health in a different form which leads not only to physical but mental agony. From the Surgeons point of view the intended cure is not complete as wound infection accounts for increased morbidity and even more so as it is seen as a preventable disease to some extent by adherence to pre-operative, intra-operative care and stringent In-hospital practices.

And, finally the cost incurred in the form of prolonged hospital stay, wages lost and decreased productivity compounds the issue (1).

Hence, a reduction in wound infection level has marked benefits in terms of both patient comfort and resources used as highlighted by the study by Olson & Lee at Minneapolis Veterans Administration Hospital which claims of a saving of $ 3 Million in in-patient services alone over a period of 9 years with a reduction of wound infection rate from 4.2% to 2.5% (9).

2.HISTORY

For most of Surgical History, death from infection was the expected result. Mortality rates for amputation in times of war during 1745 to 1865 were between 25 to 90% and between 5 to 50% in civilian practice (2). Dr.Ignaz Sammelweiss, a Hungarian Surgeon/Gynecologist practicing in Vienna in 1840 realized that surgical infection was transmissible from person to person. By noticing that puerperal sepsis was high in women treated by Physicians attending on them after Necropsy which was reduced significantly by hand washing with hypochlorite solution (3).

Joseph Lister in the 1860s was aware of the germ theory of Louis Pasteur (1861) and applied it to surgery by washing wounds with carbolic acid in order to prevent “Wound putrefaction” and was very successful in reducing the rate of wound sepsis. This is considered to be the single advancement that reduced the mortality in Surgery. Although initially his methods were resisted by many, gradually they were adopted. Sterilization of instruments, first by chemicals and then by steam, came into practice in the 1880s and 1890s. Hand washing and using of masks, caps, gowns and gloves were introduced around this time. Theoder Kocher, who developed and perfected Meticulous bloodless surgery, reported 2.3% Infection rate in Thyroid Surgery, underscoring the importance of careful tissue handling and meticulous technique as a means of reducing wound infection. Another major breakthrough that enabled control and treatment of wound infection was the discovery of penicillin by Alexander Fleming in 1928 which was put into clinical use by Howard Florey in 1940 (4).

In 1961, John Burke, had published the critical experimental study on the timing of effective Chemoprophylaxis which showed that systemic antibiotics were most effective within 3 hrs of infection and hence has to be present in adequate amounts in the peri-incision period for maximum efficacy (5).

The prospective study of Peter J.E. Cruse and Rosemary Foord at Foot Hills Hospital in Calagory, Albetare, Canada is considered to be a benchmark in studies on wound infection. The first was in 1973 when they reported on 23,649 wounds over a 5year period and subsequently in 1980, reported on 62,939 wounds over a 10 year period (7).

3. OBJECTIVES

- To study the Incidence of Wound infection in post-operative patients over a period of 6 months from August 1st 2007 to January 31st 2008.
- To analyse the factors influencing wound infection among post-operative patients.
- To analyse the outcome of Infected cases.

4. LITERATURE REVIEW

DEFINITIONS

In order to discuss wound Infections rationally certain terms need to be defined. A set of definitions was put forth in 1964 by the National Research Council, Adhoc Committee on Trauma, to help predict the probability of wound infection based on the degree of intraoperative bacterial contamination.

CLEAN :

Elective, primarily closed. No Acute Inflammation, No entrance of normally or frequently colonized body cavities (Viz) gastro intestinal, orpharyngeal, genito urinary, salivary or Tracheo bronchial tracts and no break in sterile technique.

CLEAN CONTAMINATED:

Non-elective case that is otherwise clean, controlled opening of a normally colonized body cavity, minimal spillage or break in sterile technique, re-operation through clean incision within 7 days, Negative exploration through intact skin.

CONTAMINATED:

Acute non purulent inflammation encountered, major break in technique or spill from hollow organ, penetrating trauma less than 24 hours old, chronic open wounds for grafting.

DIRTY:

Purulence or Abscess encountered or drained, preoperative perforation of colonized body cavity, penetrating trauma more than 4 hours old (8).

In the present study, the class III or " contaminated" includes all the wounds meeting "Dirty" definition also, a pattern adhered to in one of the major studies by Olson and Lee (9).

FACTORS INFLUENCING THE RATE OF INFECTION:

Two major factors determine whether a wound will become infected or not.

They are:

i) The dose of bacterial Contamination.

ii) Resistance of the patient.

One of the popular hypothesis put forward by Altmeier and Culbertson, states that the risk of wound infection varies according to the following equation (10)

$$\text{Risk of SSI} = \frac{\text{Dose of Bacterial Contamination x Virulence}}{\text{Resistance of the host}}$$

This equation explains the heavily contaminated wound, healing without infection in a patient with good host defence mechanism.

Though this is one way of approaching the issue a recent review of this subject analyses them at three different levels viz., Patient level, Wound level and Tissue level and the factors inherent to each area has been discussed (11).

PATIENT LEVEL FACTORS

These are further divided into two categories : **Endogenous and Exogenous.**

Endogenous factors, refer to the unique attributes of the patient which either may (eg. obesity) or may not (eg. Age) be alterable prior to Surgery.

Exogenous factors refers to those which are not unique to any patient which can frequently be influenced by the surgeon (eg. length of operation).

ENDOGENOUS FACTORS

Age

Extremes of age have long been thought to influence the likelihood of wound infections, may be owing to decreased immunocompetence. A prospective study of 8474 patients by Mead et al confirm to this view, as clean wound infection rate in patients <1 yr (2.7%) or >50 years (2.8%) versus those to 1 to 50 years old (0.7%) are observed (12). But G.I. Egea et al studied 4468 clean wounds and found an Infection rate of 3.4% in patients less than 65 years old and 2.7% in those 65 or older (13). Hence, age, an obvious endogenous characteristic, though is a risk factor for wound infection, appears to be a modest one.

Pre-Existing Illness

It has been logically assumed that wound Infections are more common in patients with multiple pre-existing diseases. SENIC (Study on the Efficacy of Nosocomial Infection Control) project in 1970, identified four independent risk factors, one of which was three or more diagnoses at the time of discharge (excluding those reflecting surgical wound infections and their complication) (14). A Risk-index was developed which was modified by Culver, by

replacing the number of discharge diagnoses by the American Society of Anesthesiologists (ASA) pre-operative assessment score. This modified index was validated in 84,691 procedures in 44 hospitals from 1987 to 1990. The overall Wound Infection rate among patients with ASA scores of I & II was 1.9% whereas among those with III to V it was 4.3%, which indicated “pre-existing illness” as a risk factors with strong correlation (15).

Diabetes Mellitus

Although the pathophysiology of impaired Wound Healing in Diabetics is not completely understood, several studies, seem to indicate that it is a significant risk factor for wound infection including the original 5 year study by Cruse & Foord (6), in which, the clean wound infection rate was 10.7% in Diabetics, compared with an overall clean wound infection rate of 1.8%.

Obesity

Although intuitively a risk factor, obesity has not consistently been found to be related to wound infection, though some studies, (Cruse and Foord), incriminate obesity for increased wound infection, it is not clear whether it was independent of other associated diseases. Ehrenkranz in 1981 studied a subset of 52 non-obese patients and recorded eight infections in each group. Therefore, obesity as a risk factor for wound infection, has only a weak association.

Length of Pre-operative Hospitalization

Longer duration of Pre-operative hospitalization is associated with wound infection. Theoretically, via colonization with multiple resistant organism – both 5 year and 10 year studies by Cruse and Foord and the study by Mead et al support this, but none of these studies considered Co-Morbid factors such as other Medical illness. Also no attempt is made to correlate the length of pre-operative hospitalization with either colonized skin flora or organism grown from infected wounds. Hence, the association between pre-operative hospitalization and wound infection is considered unproven (11).

Malignancy

The presence of Malignancy and Co-existing alteration in Immune status has been considered a risk factor for wound infection. Several studies, however have failed to show an independent correlation between the two. Lewis in a 1977 review of 444 Gastric Operations, found no independent association between malignancy and wound infection (17). Claesson and Holmlund in a study of 190 patients, undergoing colonic operations, found that the wound infection rate among those with Malignancy was 17% versus 4.5% for those without Malignancy (18). But given the abundant data supporting an Immunologically mediated association between blood transfusion and poor outcome from the resection of colorectal Malignancy, the study population might have been expected to show a correlation between Malignancy and

wound infection. Malignancy, therefore cannot be considered an independent Risk factor for Wound Sepsis.

Remote Site Infections

A study by Edwards in 1976 involving 1865 patients found an epidemiologic correlation between remote site infection and subsequent surgical infection, more so involving a medical device such as urinary catheter (19). But this does not highlight whether preoperative treatment of the remote site infection reduced the subsequent risk to the wound. But with the current practice of screening and appropriate treatment of Remote site infection prior to surgery, the question – whether risk of wound infection reduced after treatment – remains unanswered. But still it is recommended to consider Remote site infection as a Risk factor and treat it appropriately, prior to operation.

Malnutrition

Many studies underscore a positive correlation between Malnutrition and Wound infection. To site an example, in 1955, Rhoads & Alexander published a retrospective study of 102 surgical patients, 42 of whom were found to be hypoproteinemic (serum protein < 6.3 g/dl). The wound infection rate was 29% among hypoproteinemic group versus 15% for 60 control patients. In this study and others one of the common factors taken into consideration to quantify Malnutrition was serum albumin levels (11).

A study by Ehrenkrenz found no significant difference in clean Wound infection rates between patients with Serum Albumin greater than 3.4, 2.8 to

3.4, or less than 2.8 mg/dl which implies an Independent association between Malnutrition and wound infection does not exist (16).

EXOGENOUS FACTORS

Surgeons Hands

Though transient bacteria are reduced by soap and water, they rapidly regenerate inside the glove, making an antiseptic essential for scrubbing. Out of various chemicals used Povidone – Iodine and Chlorohexidine are found to be most suited as they are effective against both gram +ve and gram –ve organizisms. The variation comes in the length of the scrub which might vary from surgeon to surgeon.

Dineen made bacterial count of surgeons hands at the end of two-hour operations and found no difference between five and ten minute scrubs provided an antiseptic was used (20). As the optimum or minimum period of scrubbing, suggested above is adhered to by almost all, this is not a very serious risk factor as far as wound infection is concerned.

Glove Punctures

Logically, punctures in Surgeons gloves should predispose to wound infection. Cruse and Foord studying the glove with an electronic tester from the Surgeons of 1209 patients, found 141 to be punctured but without single wound infection. Recently whyte et al in 1991 studied 188 patients undergoing cholecystectomy and found no correlation between the presence of glove punctures or tears and the number of Incisional bacteria or occurrence of wound infection (21). The efficacy of the pre-operative scrub may be

responsible in preventing significant contamination. Hence, this also does not figure as a potential Risk Factor.

Emergency Procedures

Many studies have shown emergency operations to be particularly prone to wound Infectious. Garibaldi et al reported a wound infection odds ratio of 7.6 (95% confidence internal, 3.2 to 18.2) for emergency Vs elective operations but after Multivariate analysis this factor was no longer significant (22). So, Emergency operations by themselves, do not predispose to Wound infections.

Duration of Operation

Risk of wound infection is directly proportional to the operative procedure. This has been consistently shown in various studies.

Cruse & Foord	1 hr or less	3 hrs and More
	1.3%	4%
Garibaldi et al	< 2 hrs	> 2 hrs
	3.3%	14%

Haley et al from the first 58,498 patients of the original SENIC Report, also found duration of operation of greater than 2 hrs to be the second greatest independent predictor. But one question is what is “Length” for a given operation. To address this problems Culver et al, modified’ the SENIC index by considering the procedure lengthy if it lasted beyond 75th Percentile for similar other procedures rather than fixing an arbitrary time (as 2 hrs).

Using this modification, operation time was one among the three variables, other two being Wound class, and ASA class, that independently predicted Infection. Hence, it is considered as a significant risk factor for Wound infection (15).

However, in the present study only 3 groups are recognized. Surguries lasting < 1 hr, 1-2 hrs and > 2 hrs.

Air Borne Contamination

With the exception of rare epidemics traced either to Air handling or surgical staff, Airborne contaminations in General Surgery appears to play a small role in the pathogenesis of wound infections (23).

The Operating Surgeon

A given surgery can be performed by different people in different ways. The execution can vary with experience with the Trainee Surgeon/Intern Occupying the lowest rank of the hierarchy and the Chief / Consultant at the top. Schekler in his article expressed concern that significant changes in one surgeons wound infection rates could be either impossible or impractical to detect within realistic survey periods and also, that all surgical procedures are team events from a human factor epidemiology. Perspective and that hospital accreditation bodies or surgeon credentialing programs may easily misconstruct wound infection data (24).

Still this factor has been analysed to know if there is any difference at all and if so will it confirm with the operating experience of the performing surgeon. Monitoring and reporting of surgeon-specific infection rates, as one

of the recommendations in wound surveillance programme, laid down by surgical infection task force, to bring down wound infection rates. Hence, this should be rated as an important factor (32).

WOUND LEVEL FACTORS

Wound Class

The wound classification system proposed by the National Research Council in 1964 continue to be useful even (Table 4.1) 30 years later.

Table 4.1: 1. **Comparison of data of some frequently cited studies in incidence of wound infection based on would class.**

Institution	Year(s)	Patients No.	Class infection rate (%)			% of overall incidence
			I	II	III	
Mpls – VAMC	1977-86	40915	1.4	2.8	8.4	2.5
Foot Hills Hospital Collagary Canada	1967-77	62939	1.5	7.7	15.2/40	4.7
NAS-NRC	1964	15613	5.1	10.8	16.2/29	7.5
SENIC	1975-76	59352	2.9	3.9	8.5/12.6	4.1

Source : (9)

Class I - Clean

Class II - Clean – Contaminated

Class III - Contaminated

In rows 2,3,4 the figures appearing after the slash under the column III denotes Infection rate in “Dirty” cases which was incorporated into Class III itself in VAMC study.

As it is depicted, infection rate is lowest for clean cases, increases through clean contaminated and reaches a high in contaminated / Dirty cases. Hence, it is a single factor predictive of Wound infection and considered as the most important Risk Factor.

Wound Contamination

Wound contamination, as demonstrated by Intraoperative culture has been shown to be associated with later wound infection. To enable this study an intraoperative collection of culture sample is necessary which is not adopted as a routine. It has been highlighted in a study by Claesson and Holmlund which is a prospective study of 190 patients subjected for colorectal surgery, in which all wounds are theoretically classified as clean contaminated. Five or more CFU/ml (Colony Forming Unit) of bacteria in peritoneal fluid are predictive of wound infection [Infection rate without contamination (6.4%); with contamination – (41.2%)]. Hence, it has been recommended that any further studies on wound infection should incorporate this important variable (18).

Drapes

Three materials are currently in use to isolate the area of incision i) Conventional Cotton Drapes ii) Disposable Prefabricated Drapes and iii) Plastic Adhesive Drapes. The problem with cotton drapes is “bacterial strike through”, as it gets wet, from an unsterile (unprepared) area to the surgical site. This problem can be overcome by placing a sterile plastic sheet over the instrument area which is likely to get wet before applying the drapes. Once it

is done cotton and prefabricated drapes compare equally on their efficacy and selection is based only on economic basis (1).

But use of Adhesive plastic drapes has shown an increased Infection rate because bacteria proliferate with sweating beneath the drapes (25).

Pre-Operative hair Removal

Serropian and Reynolds in 1971 reported a wound infection of 5.6% after rezor shaving and 0.6% after depilator use and 0.6% after no hair removal (26). In 1983 a vivid study by Alexander et al reported on 1013 patients randomized to shaving or clipping on the evening before or the morning of operation. Observations reveal that morning clipper group recorded the lowest incidence (3.2%) and others were significantly high (27). Hence, the preferred method is one of depilation or clipping just prior to operation.

TISSUE LEVEL FACTORS AFFECTING THE INCIDENCE OF WOUND INFECTIONS

Simple but very effective steps to ensure good wound healing should be: complete hemostasis, adequate blood supply, removal of all devitalized tissue, obliteration of dead space, use of non-absorbable sutures and wound closure without tension.

Tissue Perfusion

Specific Considerations for preventing wound infection should relate to perfusion of a wound as it is crucial to healing as it ensures delivery of oxygen and neutrophils. Owing to the inevitable poor perfusion area of 50 to 100 Mm,

the normal wound environment has a Po2 of 50 to 60 mm Hg and a pH of 6.5 to 6.9 (28). Presence of a foreign body decreases the O2 tension precariously to as a low as O mm Hg near the Foreign body. In this setting the methods cited above ensures better healing gain significance (29).

The one other factor that enhances O2 tissue is administration of systemic Antibiotics.

ANTIBIOTICS

The era of chemotherapy for Infectious diseases is more than 40 yrs old which is marked by continuous development and introduction of newer antimicrobial agents. Initially the control of Infection was phenomenal but no sooner they were introduced, that is in the mid 1940s, the phenomenon of Drug Resistance of Bacteria cropped up and a newer dimension to Nosocomial Infections was added with the emergence of newer strains of bacteria that were not amenable to the existing antibiotics, thus increasing the morbidity and mortality (30).

This led to the revelation that “Inappropriate” use of antibiotics – (i.e) instances in which a different drug was thought to be preferable, the dose was considered in-appropriate or the administration of any antimicrobial therapy or prophylaxis was unjustified-accounted for Drug resistance (31).

To avoid this problem many a guideline has been proposed to develop a consensus and uniformity. Recently Page et al of the Surgical Infection Society

have proposed a guideline. The salient one being that, clean wounds do not require antimicrobial prophylaxis except in situations where infection would be disastrous including Prosthesis placement, central nervous system operations and cardiac procedures requiring cardio pulmonary bypass. The usefulness of prophylaxis therapy in clean-contaminated wounds and that of pre-operative antibiotic is a must among contaminated wounds. Stress is laid upon timing of prophylaxis, such as initiation at the time of induction and restricting them to 24 hrs and also avoidance of excessively broad spectrum antibiotics for prophylaxis (32).

SURVIELLANCE

No review on wound infection would be complete without stressing the importantance of surveillance. It has been authentically shown to reduce the incidence of wound infection in various studies (7, 8). In order to ensure consistency in this important area the surgical wound infection task force comprising of centers for disease control, surgical infections society, etc., has laid down a set of recommendations to reduce the rate of surgical wound infection to the barest minimum possible.

5.MATERIALS AND METHODS

SETTING

The study was conducted at Thanjavur Medical Collage and Hospital ,Thanjavur.

In the surgical side, there are 6 general surgery units, each unit being headed by a Chief under whom there are 2 Assistant Professors, 4 Trainee (M.S.) & 5 Interns. Every unit has a bed strength of 30 which includes Male, Female and special ward sections apart from beds in the postoperative ward.

Out patient department functions on all days in the forenoon session with each unit having one Admission day a week and Sunday taken on rotation basis. On an average 90 patients (80-100) are seen in the OPD and around 15-20 Admissions(excluding trauma) are made daily.

Operation Theatre: There are 2 suites available for General Surgery exclusively, One for major cases and the other for minor cases. Regular operation theatre timings was from 8.00 a.m. to 2.00 p.m. Emergencies were handled in a separate theatre during regular working hours. A minimum of 4 major cases were posted every day.

Patient Preparation: Shaving is carried out in the morning of surgery after which the patient is given a bath. The area of operation is prepared with povidone Iodine solution and covered with a sterile towel/bandage.

Scrubbing: Povidone Iodine scrub was used and the time was a minimum of 5 minutes.

Post Operative Follow-up: In the Immediate period, all cases were received in the post-operative observation area. Cases done under spinal anesthesia were retained only until they recovered from the spinal effect and then transferred to the ward. Uncomplicated Laparotomies were shifted to the ward after overnight observation. Only those with poor risk eg. ASA III and above, or those who needed nutritional/ventilation support were retained beyond two days in the post operative ward.

Wound Examination: First look on the III P.O.D. unless there was any suggestion of infection. Wound was left open ,Tincture Benzoin paint applied over it if it was clean.

Antibiotic Policy: Clean cases were not administered antibiotics. Clean contaminated cases used to have 3 doses of antibiotics. i. at the commencement of surgery, ii. 8 hours later, iii. 24 hours later. Contaminated cases were started on preoperative antibiotics. Per-operative cultures were sent. Therapy was rescheduled based on sensitivity tests, later or the initial antibiotic(s) were continued if clinically the patient appeared responding to it.

STUDY PERIOD

The study was carried out on patients who underwent surgery from August 31st 2007 to January 31st 2008 (6 months period).

STUDY SAMPLE

It included all the patients from the General Surgery Unit -IV who underwent surgery during the specified period. Patients Undergoing minor surgical Procedures as out patients or as an In-patient sometimes (eg.Circumcisions, Small Fibroadenoma , Lipoma, Sebaceous cyst, Dérmoid cyst) were excluded from the study.

RECORDING OF DATA

This was done using a proforma, a sample of which is enclosed – Appendix – 1. The actual entry was made by the trainee (M.S.PG) or intern IV unit.

CLASSIFICATION OF CASES

They were grouped into three categories. Clean, clean-contaminated and contaminated based on the criteria already briefed. The class of Dirty cases were grouped along with contaminated cases as it was done in the study by Olson and Lee (9).

SURGERY DONE

In the initial data collection the exact procedure was recorded. For Analysis they were grouped as,

Abdominal wall surgery-
Laparotomies
Genito urinary surgeries
Head and Neck Surgeries
Limb Surgeries
Others.

NATURE OF SURGERY

Whether the surgery performed was an Elective or Emergency procedure.

RISK FACTORS

They were considered under two different categories. General & Specific / local.

General: Presence of Anemia, Diabetes Mellitus, Tuberculosis, Malignancy, Immuno-Suppression.

Specific / Local: URI, LRI, UTI, Focal Sepsis, Viz. localized gangrene, abscess, fungal Infection etc.

PER-OPERATIVE FACTORS

The per-operative factors taken into consideration were.

Duration of Surgery

The time taken into account was from the time of Induction of anesthesia to skin closure. Three specific time periods were allotted.

< 1 hr, 1 to 2 hrs, > 2 hrs.

Performing Surgeon

It was based not on individuals but the post occupied in the hierarchy. Whether it was the chief, or Assisstant Professor or Trainee/Post Graduate or the Intern to know if at all it had any bearing on the outcome of wound infection.

ANTIBIOTICS

It was analysed in 2 different timings – Pre-Operative & Per-Operative.

Pre-Op. Antibiotics usage could have been, deliberate as in contaminated, clean contaminated cases. Incidental if the patient had been on antibiotics for some other reason such as LRI, URI, Focal Sepsis etc.

Per-operative – as a part of Prophylactic Regimen or If there had been an undue prolongation in surgery time or unexpected contamination during surgery.

IDENTIFICATION OF WOUND INFECTION (in the post operative period)

This was based both on clinical and Microbiological Findings.

Clinical: Any redness, swelling, tenderness, with or without constitutional symptoms. Fever > 100` F was regarded as "Infected" even though no frank pus / or any other discharge was present.

Microbiological: If there was discharge of any kind, serous / sero sanguinous a swab was sent for culture and sensitivity at the time of detection and if it grew any organisms, the case was considered "Infected" even though the other tell tale clinical signs were not present.

Clinical and Microbiological: If both clinical findings and a positive culture were present then also it was regarded as Infected.

In the absence of the above said criteria the case was one of **Not Infected.**

ANALYSIS OF INFECTED CASES

Among the Infected cases the following factors were analysed.

Day of Detection: The day on which, the case was clinically adjudged to have wound infection or the day on which a swab was sent from a suspected discharge from the wound site which subsequently turned positive for organisms or whichever was earlier.

Method of Detection: Whether it was Clinical, Microbiological, or Clinical & Microbiological.

Organism Grown: They were classified into 6 groups

0. No Growth
1. Staph and Strep Species
2. Klebsiella, Escherichia Species
3. Pseudomonas Species
4. Citrobacter Species
5. Others.

Outcome: Whether the case resolved or not resolved.

Resolved: Symptoms and signs abate following treatment in the form of drainage of collection and / or administration of systemic Antibiotics. Also if the infection was limited to the superficial layer and ultimately wound healing was good following secondary suturing.

Not Resolved: If the patient went into Septicemia, developed Fistulae, wound dehiscence or cutaneous gangrene.

STATISTICAL ANALYSIS

Data entry was done using Excel Software and analysed using EpiInfo Statistical Package (Version 6.04, WHO & CDC) Univariate analysis was done to identify risk factors for Wound infection. Chi-square and Fishers exact tests were used for Hypothesis testing. The level of statistical significance was set at 0.05.

6.RESULTS

6.1 Overall Incidence of Wound infection

Table 6.1. Distribution of Wound Infection (N = 245)

Wound	Frequency	Percent
Not Infected	217	88.6
Infected	28	11.4
Total	245	100

Total no. of patients included in the study was 245.
The overall Incidence of Wound infection in the present study is 11.4%.

6.2 Age Distribution of Patients

In the sample studied

Minimum Age : 16 years
Maximum Age : 75 years
Median : 35 years

For the sake of Analysis they were subdivided into 4 groups.

Group 1 : up to 20 years
Group 2 : 21 – 40 years
Group 3 : 41 – 60 years
Group 4 : 61 and above years

and the frequency of Distribution is as follows:

Table 6.2: Age Distribution in the Study Sample [N = 245]

Age Group	Frequency	Percent
1	37	15.1
2	113	46.1
3	73	13.0
4	22	9.0
Total	245	100

6.3 Sex Distribution of Patients [N = 245]

Table 6.3 Sex Distribution

Sex	Frequency	Percent
Male	193	78.8
Female	52	21.2
Total	245	100

6.4 Surgery Performed [N = 245]

In the primary data collection. Individual Surgeries were entered. While analyzing for Frequency of distribution and Risk Association subsequently they were grouped broadly under 6 categories.

Table 6.4 Distribution of Surgery performed.

Group	Frequency	Percent
1	72	29.4
2	93	38.0
3	35	14.3
4	22	9.0
5	7	2.9
6	16	6.5
Total	245	100

Group I : Abdominal wall Surgeries:

Inguinal Herrniorrhaphy/Hernioplasty

Incisional Hernia Repair ANATOMICAL REPAIR

MESH REPAIR

Group 2: Laporotomies : (Mainly G.I.Tract Surgeries)

GJ Vagotomy

Cholecystectomy

Appendicectomy

Resection and Anastamoses

Perforation Closure

Hemicolectomies etc.

Group 3 : Genito Urinary Surgery

Hydrocele – excision and eversion

Orchidopexies

Orchidectomy

Carcinoma Penis - Total Penectomy with perineal Urethrostony

Partial Penectomy

Group 4 : Head – Neck Surgery

Thyroidectomies

Salivary Gland Tumour – Surgeries

Group 5 : Upper and Lower Limb Surgeries

Amputations Above Knee

Below Knee

Varicose Veins - Trendelenberg Operation

Avulsion & Ligation

Lintons Procedure

Group 6 : Others

Lumbar – Sympathectomy

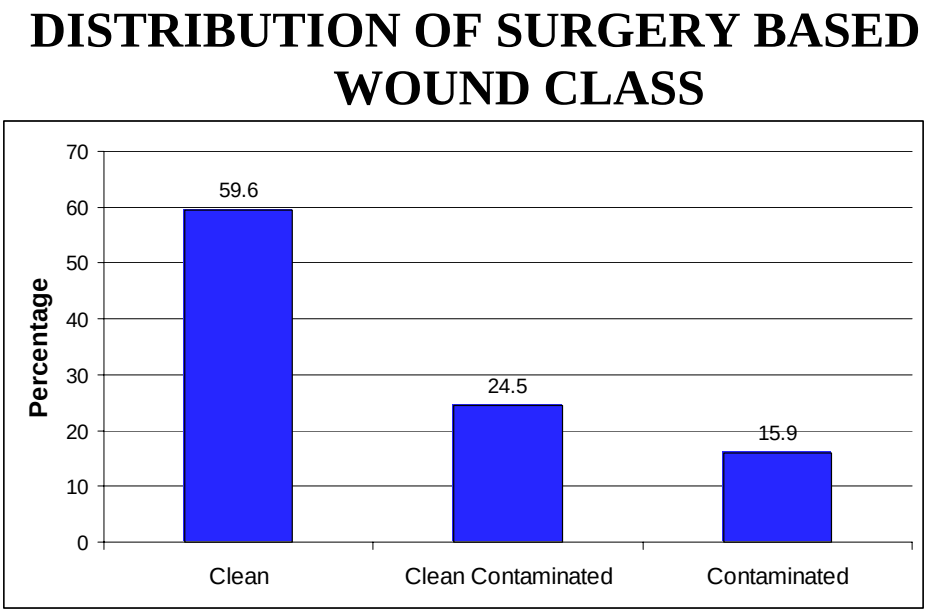
Breast Surgery – Mastectomy with Axilliary Clearance

As depicted in Table 6.4 Laparotomies occupy the major part at a frequency distribution of 38% followed by Abdominal wall surgeries (29.4), Genito Urinary Surgery (14.3%), Head and Neck Surgery (9%) others (6.5%) and Limb Surgeries (2.9%).

6.5 Type of Surgery [N = 245]

Table 6.5 Distribution of Surgery based on wound class

Type	Frequency	Percent
Clean	146	59.6
Clean Contaminated	60	24.5
Contaminated	39	15.9
Total	245	100



6.6 Nature of Surgery [N = 245]

Table 6.6 – Distribution of Emergency & Elective Surgery

Nature	Frequency	Percent
Emergency	52	21.2
Elective	193	78.8
Total	245	100

As shown in Table 6.6 the frequency of Emergency procedures were 21.2% and that of Elective procedures was 78.8% in the sample studied.

6.7 Risk Factors

They were considered under two different categories – General and Local / Specific.

6.7.1 Distribution of General Risk Factors [N = 245]

Table 6.7 A Distribution of General Risk Factors

Risk Factor	Present Frequency (%)	Absent Frequency (%)
Anemia	32 (13.1)	213 (86.9)
Diabetes	12 (4.9)	233 (95.1)
Tuberculosis	3 (1.2)	242 (98.8)
Malignancy	16 (6.5)	229 (93.5)
Immuno-supperssion	0 (0%)	245 (100)

As depicted in Table 6.7A, in the present study Anemia 32 (13.1%) in the most prevalent risk factor which is followed by Malignancy 16 (6.5%), Diabetes Mellitus 12 (4.9%). The other two factors viz., Tuberculosis 3 (1.2%) and Immunosuppression Illness 0 (0%) show a very low frequency of distribution. Hence they were not considered for further statistical Analysis.

6.7.2 Distribution of Local / Specific Risk Factors [N = 245]

6.7.B – Distribution of specific / local risk factors

Risk Factor	Present Frequency (%)	Absent Frequency (%)
UTI	15 (6.1)	230 (93.9)
URI	0 (0)	245 (100)
LRI	16 (6.5)	229 (93.5)
Focal Sepsis	10 (4.1)	235 (95.9)

Table 6.7B indicates that Urinary tract Infection 15 (6.1%) and Lower Respiratory tract Infection 16 (6.5%) were the most frequent among specific risk factors followed by Focal Sepsis / Remote Site Infection 10 (4.1%). There were no cases of URI and so it was not considered for further Statistical Analysis.

6.8. Administration of Pre-op Antibiotics [N = 245]

Table 6.8 Frequency of Administration of Pre-op Antibiotics.

Pre-Op. Antibiotics	Frequency	Present
Not Given	148	60.4
Given	97	39.6
Total	245	100

Table 6.8 shows that 97 (39.6%) among 245 were administered Pre-operative Antibiotics for the indications as already stated in the present study.

6.9. Duration of Surgery [N = 245]

Table 6.9 : Distribution of Duration of surgery

Duration	Frequency	Percent
< 1 hour	63	25.7
1 – 2 hours	109	44.5
>2 hours	73	29.8

As shown in Table 6.9 Surgeries performed between 1 to 2 hours were more 109 (44.5%) when compared to these done in less than 1 hour, 63 (25.7%) and more than 2 hours 73 (29.8%).

6.10. Operation Performed by [N = 245]

Table 6.10 : Distribution of Surgery based on performing surgeon.

Done by	Frequency	Percent
Chiefs	40	16.3
Assistant Professor	125	51
PG	74	30.2
Intern	6	2.4

Table 6.10 shows that the Assistant Professors have performed a little more than half the number of Total Cases 125 (51%); Trainees having performed 74 (30.2%); Chiefs 40 (16.3%) – Most of it would be patients, classified as ASA III and above, contaminated cases, with underlying malignancy etc.

6.11 UNIVARIATE ANALYSIS : RISK FACTORS FOR WOUND INFECTION

Table 6.11 : RISK FACTORS FOR WOUND INFECTION

S.No.	Risk Factor	Sample Size	Incidence of wound infection(%)	P value
1.	**Sex**			
	Male	245	22/193 (11.4)	0.977
	Female		6/52 (11.5)	
2.	**Age**			
	Up to 20		0/37 (0)	0.010*
	21 – 40		10/113 (8.8)	
	41 – 60	245	13/73 (17.8)	
	60 and above		5/22 (22.7)	
3.	**Surgical Procedure**			
	1		6/72 (8.3)	
	2		7/93 (7.5)	0.000*
	3	245	8/35 (22.9)	
	4		0/22 (0)	
	5		0/7 (0)	
	6		7/16 (43.8)	
4.	**Type of Surgery**			
	Clean		19/146 (13.0)	
	Clean-Contaminated	245	2/60 (3.3)	0.052
	Contaminated		7/39 (17.9)	
5.	**Nature**			
	Emergency		8-52 (15.4)	
	Elective	245	20/193 (10.4)	0.312
6.	**Anemia**			
	Present		5-32 (15.6)	0.424
	Absent	245	23/213 (10.8)	
7.	**Diabetes**			
	Yes		2/12 (16.7)	0.633
	No	245	26/233 (11.2)	
8.	**Tuberculosis**			1.000
	Yes		0/3 (0)	
	No	245	28/242 (11.6)	
9.	**Malignancy**			
	Yes		5/16 (31.3)	0.024*
	No	245	23/229 (10.0)	

10.	**UTI**			
	Yes	245	5/15 (33.3)	
	No		23/230 (10.0)	0.018*
11.	**LRI**			
	Yes	245	6/16 (50)	
	No		22/229 (9.6)	0.004*
12.	**Focus of Infn**.			
	Yes	245	5/10 (50)	
	No		23/235 (9.8)	0.002*
13.	**Pre-Op. Antibiotics**			
	Yes	245	17/97 (17.5)	0.015*
	No		11/148 (7.4)	
14.	**Duration of Surgery**			
	<1 Hr	245	5/63 (7.9)	0.342
	1-2Hrs		16/109 (14.7)	
	>2 Hrs		7/73 (9.6)	
15.	**Surgery Done by**			
	Chiefs		7/40 (17.5)	0.487
	Asst. Prof.	245	14/125 (11.2)	
	Trainees		6/74 (8.1)	
	Intern		1/6 (16.7)	
16.	**Per-Op. Antibiotics**	245		
	Yes		17/97 (17.5)	
	No		11/148 (7.4)	
				0.015*

*** -- Statistically Significant**

Fig.1 A CASE INTRA-ABDOMINAL SEPSIS WITH LAPROSTOMY

Fig.2 INFECTED APPENDECTOMY WOUND

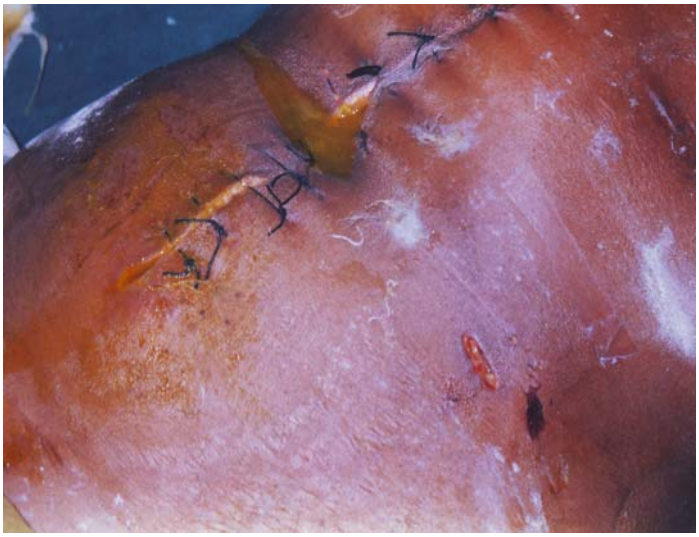


Fig.3 ENTEROCUTNEOUS FISTULA

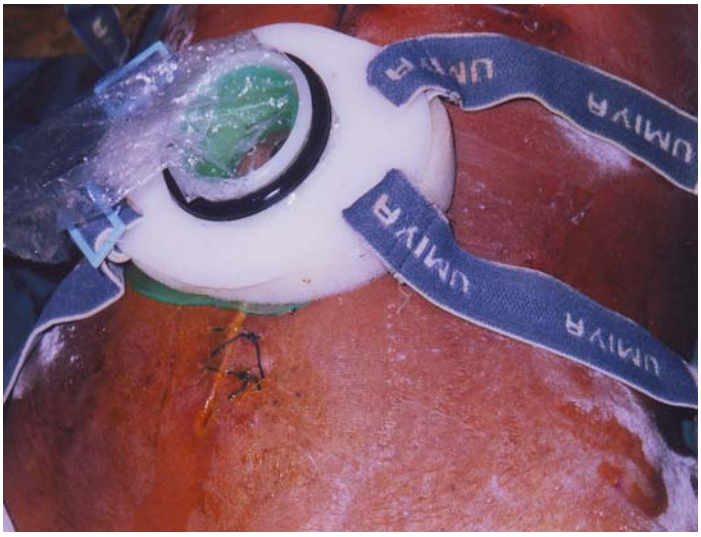


Fig.4 WELL FITTING COLOSTOMY BAG OVER FISTULA

6.12.1 ANALYSIS OF INFECTED CASES [N = 28]

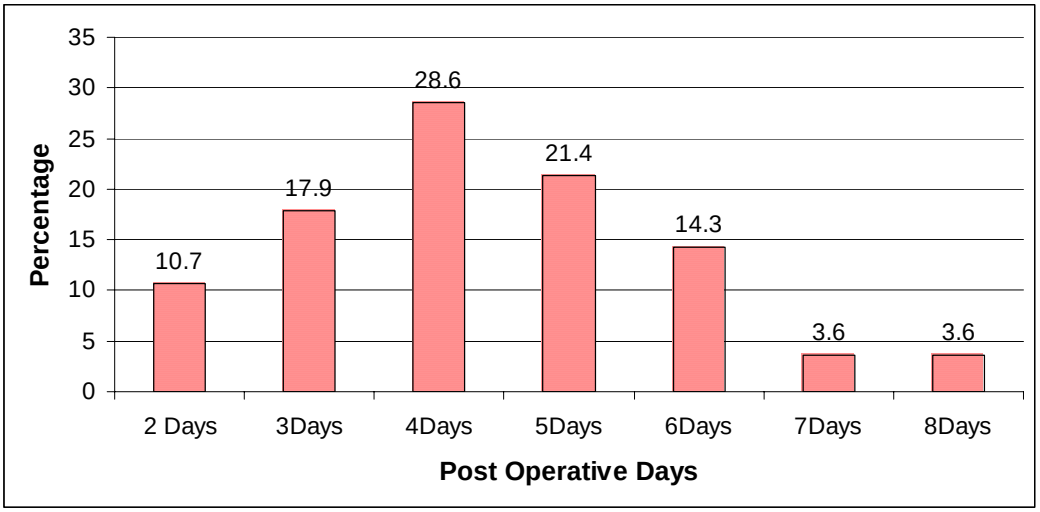
Day of Detection of Wound infection

Table 6.12A : Distribution of day of detection of wound infection

Day of Detection	Frequency	Percent
2	3	10.7
3	5	17.9
4	8	28.6
5	6	21.4
6	4	14.3
7	1	3.6
8	1	3.6
Total	**28**	**100**

As shown in Table 6.12A, the highest number of cases of wound infection were detected on the 4th P.O.D. and most of them within the first week.

DAY OF DETECTION OF WOUND INFECTION



6.12.2 METHOD OF DETECTION

Table 6.12B : Distribution of Method of detection

Method	Frequency	Percent
Clinical	7	25
Clinical and Microbiological	21	75
Microbiological	0	0
Total	**28**	**100**

Table 6.12B shows that confirmation by clinical and microbiological methods were in the order of 75% when compared to clinical impression only i.e. 25%. No case was detected purely on the growth of organism only without clinical features.

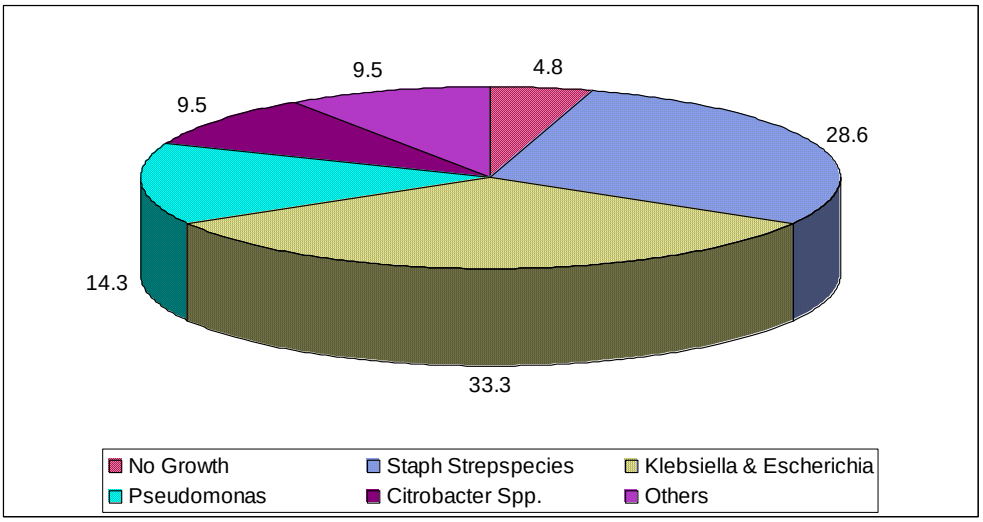
6.12.3. ORGANISM CULTURED FROM WOUND N = 21

Table 6.12C : Distribution of organisms Isolated

Organism	Frequency	Percent
No Growth	1	4.8
Staph Strep species	6	28.6
Klebsiella & Escherichia	7	33.3
Pseudomonas	3	14.3
Citrobacter Spp.	2	9.5
Others	2	9.5
Total	21	100

As Table 6.12C shows Escherichia & Klebsiella spp. Show a high frequency distribution (33.3%) closely followed by Staph & Strep spp. (28.6%).

ORGANISM ISOLATED



6.12.4 OUTCOME OF WOUND INFECTION [N = 28]

6.12D : Distribution of outcome of wound infection

Outcome	Frequency	Percent
Resolved	26	92.9
Not-Resolved	2	7.1
Total	**28**	**100**

As shown in Table 6.12D out of 28 Infected cases. 26 Resolved without major complications. Whereas 2 cases went on to have other complications.

Fig.5 WOUND GAPPING WITH GRANULATION TISSUE

7.DISCUSSION

7.1 INCIDENCE OF WOUND INFECTION

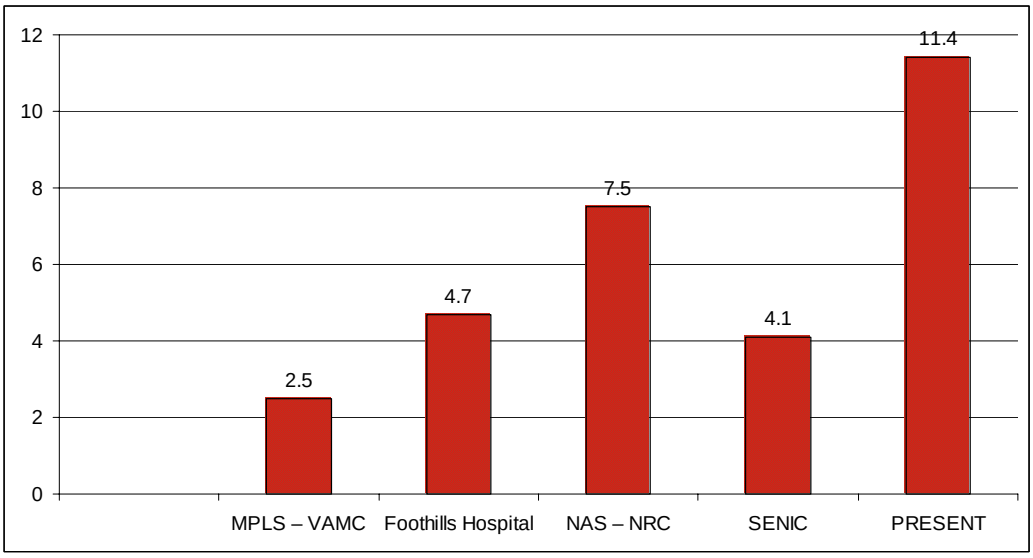
7.1.1 Overall Incidence of Wound infection

The overall Incidence of W.I in the present study is 11.4% which is quite high Compared to other studies.

Table 7.1 : Comparison of Incidence of wound infection

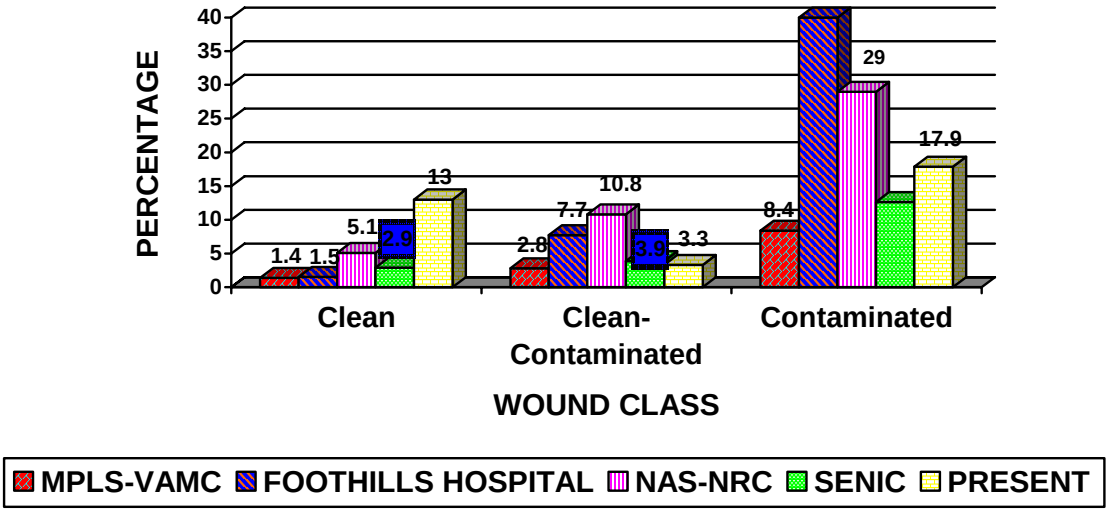
STUDY	OVERALL	CLASS INFECTION RATE (%)		
		I	II	III
MPLS – VAMC	2.5	1.4	2.8	8.4
Foothills Hospital	4.7	1.5	7.7	15.2/40
NAS – NRC	7.5	5.1	10.8	16.2/29
SENIC	4.1	2.9	3.9	8.5/12.6
PRESENT	11.4	13.0	3.3	17.9

COMPARISION OF OVERALL INCIDENCE IN WOUND INFECTION



In rows 2,3,4 the figures appearing after the slash under the column “III” denotes Infection among “Dirty Cases” which is incorporated into class III in the present study as it has been done in MPLS – VAMC study.

INCIDENCE-CLASSWISE



7.1.2 Incidience of wound infection classwise

The Incidence among clean-contaminated (3.3%) and contaminated (17.9%) categories campares favorably with other studies whereas Incidence among clean cases (13.0%) is markedly high which inturn might be responsible for the overall Incidence (11.0%).

The one factor that might have influenced such an outcome is subjective bias on the part of the observer (Trainee, Intern – who by and large have the first look at the wound), in diagnosing or rather over diagnosing wound infection among clean cases as they were operated upon without any antibiotics

cover either in the pre-operative or post-operative period as compared to other classes of surgery.

7.2 RISK FACTORS FOR WOUND INFECTION

7.2.1. Sex and Age:

In the present study the incidence among males (11.4%) and females (11.5%) are almost the same. Hence Sex does not appear to be a Risk factor for Wound infection. Whereas Age appears to have a strong association as a Risk factor for Wound Infection, a fact underscored in other studies also (1). In the present study there is a gradual increase from 0% in under 20 age group to 22.7% in persons aged 60 and above with a p value of 0.010.

7.2.2. Surgical Procedure:

Surgical Procedures were categorized based on the site of operation into six groups as Abdominal wall surgeries. Laparotomies, Genitourinary surgical, Head and Neck Surgery, Limb surgeries and other areas in that order.

The results observed shows that they have strong association as a Risk factor for wound infection with a p value of 0.000.

Among the sites as such “others” comprising of Lumbar Sympathectomy and Mastectomy with Axillary clearance as the major surgeries shows a very high incidence of Wound Infection though both are “clean” surgeries. The influencing factor may be the underlying Malignancy &

Focal sepsis (gangrene toe, non-healing ulcer foot etc) may be the reason for this association.

Genito urinary Surgeries fall next in line with an incidence of 22.9%. The preponderance of urinary tract infection in this group of patients may be the predisposing factor.

Laparotomies comprising mainly of surgeries on G.I.tract showed an incidence of 7.5% which is acceptable considering the fact that group includes contaminated cases, emergency procedure, lengthy operation and underlying malignancy which by themselves are potential Risk factors for Wound infection.

In Abdominal wall surgeries the incidence was 8.3% which is high for this category as most of the cases are “clean” case and performed as Elective procedures.

Hend & Neck surgeries and Limb Surgeries showed 0% incidence of Wound infection.

Head and Neck surgeries involved mostly clean cases whereas Limb surgeries which include mostly lower limb amputation – Above or below knee – for “Diabetic Foot”. Probably the removal of the nidus of infection and adequate coverage with antibiotics may be the reason for absenece post operative Wound infection.

7.2.3 Type of procedure (based on wound class)

In this study it denotes the wound class (based on contamination) which is considered both as an important risk factor and a predictive factor of wound infection.

In the present study with a P value of 0.0152 it is not a significant Risk factor which may be due to the discrepancy in the Incidence among clean cases when compared to other studies.

7.2.4 Nature of Surgery

Emergency operations show a higher (15.4%) rate of wound infection when compared to Elective (10.4%) procedures, which is along the expected lines as most of them would be of clean-contaminated, contaminated class and with inadequate control of any pre existing illness such as LRI, UTI etc. These factors enhance the chances of would infection among Emergency cases. Yet it is not statistically significant which is in conformity with the view expressed by Garibaldi et al. (22), that emergency procedures by themselves do not function as a risk factor.

7.2.5 Analysis of ANEMIA, DIABETES MELLITUS, TUBERCULOSIS and MALIGNANCY AS Risk factors.

Among the factors mentioned above “Malignancy” is one factor which has a strong association as a Risk factor with an incidence of (31.3%) and a p value of 0.024 in the present study.

7.2.6 Analysis of UTI, LRI, Focus of Infection as Risk factor.

All these three factors, whose incidence among patients in the wound infection are as follows – UTI (33.3%), LRI (37.5%), Focus of Infection (50%) and with p values 0.018, 0.004, 0.002 respectively show a strong association as a risk factor for Wound infection. Even though these factors are identified pre operatively and treated they have still shown a strong association as a risk factor for wound infection. The reasons for this may be inadequate control of infection, resistance of bacteria to the antibiotics exposed.

7.2.7 Duration of surgery

It has been shown in various studies that the risk of wound infection is directly proportional to the length of operative procedure (6, 22).

The present study shows a higher incidence of wound infection among surgeries performed between 1-2 hr (14.7%) and an incidence of 7.9% in the <1 hr category and 9.6% when it exceeded 2 hrs. It would be relevant to recall at this stage that in this study the duration was fixed arbitrarily and was not done on the lines recommended in the recent literature which states that a procedure is deemed “lengthy” only if it crosses the 75^{th} percentile in terms of time consumed.

The observation does not fully support the above said statement as there is a drop in incidence in surgeries performed for > 2 hrs. Also it is not statistically significant with the p value at 0.342.

Anyhow, the increase in incidence from 9.6% to 14.7%, among surgeries performed in <1 hr and 1-2 hrs respectively, is in tune with the fact that the duration of surgery is a significant risk factor for wound infection.

7.2.8 Performing surgeon

The present study shows a high incidence of wound infections among patients operated upon by chiefs 17.5%, and 11.2%, 8.1% and 16.7% among surgeries performed by assistant professors, trainees / PGs and Interns respectively. Though this observation is not statistically significant (p value – 0.487) the higher incidence among surgeries performed by chiefs can be explained by the fact, that they tend to operate on grossly contaminated cases, patients with pre existing illness (eg. ASA III and above, Malignancy, etc) and also perform lengthy surgeries. All these factors being potential risk factors, contribute to the current observation and excludes any stigma attributable to the performing surgeon.

Trainees show the least incidence of wound infection and this may be due to the fact they operate mostly uncomplicated cases.

7.2.9 Antibiotics:

Exposure to antibiotics in the preoperative period showed a strong association with wound infection (P value – 0.015). The reasons may be,

inadequate control of infection for which the antibiotics were started or bacterial resistance to the exposed antibiotics.

7.3 ANALYSIS OF INFECTED CASES:

In the sample studied 28 out of 245 patients had wound infection.

7.3.1 Day of detection

Most of the cases were detected in the first week after surgery. Nearly 50% of them were detected on 4^{th} (28.6%) and 5^{th} (21.4%) post operative days. The most delayed detection was on the 8^{th} P.O.D.

This differs from other observations where the maximum number was detected during the 2^{nd} week. With the concept of day care surgery, identification of wound infection gets even more delayed as it is picked up only during the surveillance follow up period.

7.3.2 Method of detection

In the present study it was done in one of there three ways – clinical, clinical and microbiological and Microbiological. As it is shown from Table 6.12B no cases fall in the last category i.e., exclusively microbiological means.

Out of the other 2 methods clinical method alone was employed in the detection of 2.5% of cases and the rest by both clinical and microbiological means.

Though everyone was aware of the criteria to diagnose a wound infection, it was not done by a single person. It was done by different people at

different times. As discussed already there might be an element of observer bias in this modality of detection

7.3.3 Organisms isolated

In the present study 21 out of 28 infected patients had a swab sent for culture and sensitivity at the time of detection. The results reveal the following distribution pattern. Klebsiella, Escherichia species (33.3%) and Staphylococcus & Streptococcus species (28.6%) occupy more than 60% of the total, Pseudomonas (14.3%) and Citrobacter (9.5%) and others (9.5%) form the rest of the group. No growth was reported from one of the isolates (4.5%). This is in line with other studies.

7.3.4 Outcome of wound infection

In the present study 26 out of 28 wound infections resolved. Of the remaining two, one patient went into septicemia and the other had cutaneous gangrene and septicemia.

The Limiting factor in the current study is that the observation and diagnosis was made by different people. So, while interpreting a particular finding purely on clinical grounds (eg. redness, tenderness etc.) the element of bias on the part of the observer played a crucial role. Especially while diagnosing wound infection among clean cases. As they were not routinely administered antibiotics, it might have influenced the observer in pronouncing the case as “Infected” and to start on antibiotics to prevent wound infection

early. This factor of oversensitivity in diagnosis purely on clinical grounds might be the cause for certain results in the current study. Such as increased incidence among clean cases, advancement in the day of detection of post operative wound infection, increased incidence of wound infection among abdominal wall surgery to site a few.

8.SUMMARY AND CONCLUSION

The present study on post operative wound infections, was carried out for a span of 6 months duration on a sample size of 245 patients. Analysis of the results showed an, overall incidence of 11.4% (28/245) wound infection among post operative patients. The classwise breakup of would infection based on the definitions by the National Research council Ad Hoc Committee on Trauma showed 13% (clean), 3.3% (clean-contaminated) and 17.9% (contaminated) incidence.

Analysis of the factors that influence the outcome of wound infection revealed the following:

The factors considered were Age, Sex, Pre-existing illnesses, surgical procedures pertaining to the site of operation, Nature of surgery-elective/emergency procedures, duration of surgery and performing surgeon (based on the position in surgical unit and not individuals).

As far as Sex was concerned it did not influence the outcome. The incidence of wound infection among Males (11.4%) and Females (11.5%) were more or less the same.

Increasing age showed a strong association and formed an important risk factor in the study. Under 20 age group showed 0% while 61 and above recorded an incidence of 22.7%, the p value being 0.010.

Pre existing illnesses mentioned as “risk factors” in the present study was subdivided into General and Local/Specific factors.

General factors comprising of Anemia, Diabetes mellitus, Tuberculosis and malignancy were analysed for risk association. Malignancy stood out as an important risk factor, as patients with underlying malignancy showed 31.3% incidence compared to those without malignancy – 10%, which was statistically significant (p value – 0.024). The presence of other factors, viz. – Anemia, Diabetes Mellitus and Tuberculosis, did not influence the outcome of wound infection in the present study.

Local/specific factors comprising of UTI, LRI and Focus of infection were analysed for risk association. All the three factors showed a strong association with wound infection, as their p values, 0.018, 0.004 and 0.002, respectively were significant.

Surgical procedures pertaining to the site of operation showed a strong association with wound infection (p value – 0.000). Among the different sites, those included in the group “others” comprising mostly of Lumbar sympathectomies and Breast surgery for malignancy showed the hghest incidence (43.8%). Even though both are clean surgeries the factors that would

have influenced such an outcome is the presence of malignancy and focus of infection (Non healing ulcers, gangrene toe of lower extremities) which show a strong association with wound infection in the present study. This is followed by Genito urinary tract surgeries with an incidence of 22.9% in which case pre existing UTI could have influenced the outcome.

Abdominal wall surgeries, Head and Neck surgeries and Limb surgeries recorded an incidence of 8.3%, 0% respectively.

As far as the nature of surgery was concerned, the incidence of wound infection was more in emergency 15.4% when compared to that of elective procedures 10.4%. But statistical significance could not be established with a p value of 0.312, as it showed a weak association with wound infection.

Regarding the duration of surgery which is considered as an important predictor of wound infection in the current study the baseline data confirms with this view as the incidence rate increases from 7.9% (<1 hr) to 14.7% (1-2 hrs.) but falls to 9.6% (>2 hrs). Again a strong association with wound infection could not be established with a p value of 0.342. Similarly the factor of performing surgeon did not show an association that was statistically significant (p value – 0.487).

The association of wound class with wound infection showed, 13% (clean), 3.3% (clean-contaminated), 17.9% (contaminated), incidence in the present study. The higher incidence among clean cases may be attributed to the bias on the part of the observer in over diagnosing wound infection only on clinical grounds.

Use of antibiotics has shown a strong association with wound infection (p value – 0.015) may be due to inadequate control of infection for which the antibiotics were started or the resistance of bacteria to the antibiotic exposed.

Analysis of infected cases revealed that 92.9% of them showed complete resolution and 7.1% had complications. Day of detection of wound infection was mostly on fourth post operative day. Mode of identification was based on clinical and microbiological means combined together (75%). The most common organisms isolated were staphylococcus and Streptococcus, Escherichia and Elebsiella species (60% both together) followed by Pseudomonas, Citrobacter and other organisms.

CONCLUSION

The present study showed, overall wound infection incidence of 11.4%. Class wise 13.0%, 3.3%, 17.9% in clean, clean-contaminated and contaminated cases respectively.

The factors which showed a strong association with wound infection were increasing age, surgical procedure pertaining to the site of operation, presence of malignancy, urinary tract infection, lower respiratory tract infections, focus of infection and exposure to antibiotics.

Factors such as wound class, emergency procedure, duration of surgery, presence of Anemia, Diabetes Mellitus or tuberculosis did not associate strongly with wound infection.

Among the Infected cases [N = 28]

* 92.9% resolved completely, 7.1% went on to have complications.
* 4^{th} post operative day was the commonest day of detection of wound infection
* combination of clinical and microbiological means were the common mode of detection rather than individually.
* Staphylococcus and Streptococcus, Klebsiella and Escherichia were the most common organisms isolated from the infected wounds.

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OUND	AGE	SEX	SURG DONE	TYPE	NATURE	RISK FACTORS									PRE-OP ANTI-BIOTICS	PER-OP			INFECTED C/		
						GENERAL					LOCAL							ANTI-	DAY OF		
						AN	DM	TB	MAL	IM-SP	UTI	URI	LRI	FCS		DURTN	D/BY	BIOTICS	DETN	METHOD	ORGAN
0	68	1	2	3	1	0	0	0	0	0	0	0	0	0	1	3	1	1			
0	29	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
0	17	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	1	0			
0	20	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
1	56	1	3	1	2	0	0	0	0	0	1	0	0	0	1	1	3	0	3	1	
1	65	1	2	3	1	1	1	0	0	0	0	0	0	0	1	2	1	1	4	3	4
1	30	2	6	1	2	1	0	0	1	0	0	0	0	0	1	3	1	1	4	1	
0	72	1	1	1	2	0	0	0	0	0	1	0	0	0	0	2	3	0			
0	32	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	4	0			
1	47	1	1	1	2	0	0	0	0	0	0	0	1	0	1	1	1	1	2	1	
1	60	2	6	1	2	0	0	0	0	0	0	0	0	0	0	2	2	1	5	3	5
0	61	2	4	1	2	0	1	0	0	0	0	0	0	0	0	3	2	0			
0	37	2	2	2	2	1	0	1	1	0	0	0	0	0	1	3	2	1			
0	34	2	2	2	2	0	0	0	0	0	0	0	0	0	1	3	3	1			
0	51	1	2	3	1	0	0	0	0	0	0	0	0	0	1	2	3	0			
0	20	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			
0	18	1	2	3	1	0	0	0	0	0	0	0	0	0	1	2	3	0			
0	55	1	2	3	1	1	0	0	0	0	0	0	0	0	1	2	2	1			
1	25	1	3	1	2	0	0	0	0	0	1	0	0	0	0	2	2	0	4	3	2
0	70	1	2	2	2	0	0	1	0	0	0	0	0	0	1	3	2	1			
0	16	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
0	24	1	3	1	2	0	0	0	0	0	1	0	0	0	0	1	3	0			
0	55	1	4	1	2	0	1	0	0	0	0	0	0	0	1	2	2	0			
0	29	1	2	3	1	0	0	0	1	0	0	0	0	0	0	2	3	1			
0	27	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
0	42	1	2	2	2	0	0	0	0	0	0	0	0	0	0	3	2	1			
1	55	1	3	3	1	0	0	0	0	0	0	0	1	0	1	3	1	1	5	3	3
0	27	1	3	2	2	0	0	0	1	0	1	0	0	0	1	2	2	0			
0	45	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
0	48	1	6	1	2	0	0	0	0	0	0	0	0	1	1	2	2	0			
1	50	2	2	1	2	0	0	0	1	0	1	0	0	0	1	1	1	1	2	1	
0	16	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			
0	19	2	4	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
0	34	2	4	1	2	0	0	0	0	0	0	0	0	0	0	3	2	0			

WOUND	AGE	SEX	SURG DONE	TYPE	NATURE	RISK FACTORS									PRE-OP ANTI-BIOTICS	PER-OP			INFECTED C/		
						GENERAL					LOCAL							ANTI-	DAY OF		
						AN	DM	TB	MAL	IM-SP	UTI	URI	LRI	FCS		DURTN	D/BY	BIOTICS	DETN	METHOD	ORGAN
1	42	2	6	1	2	0	0	0	1	0	0	0	0	0	1	3	2	0	4	3	2
0	22	2	4	1	2	0	0	0	0	0	0	0	0	0	0	3	2	0			
0	27	1	2	1	2	0	0	0	0	0	0	0	0	0	0	3	2	1			
0	53	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
0	45	2	4	1	2	0	0	0	0	0	0	0	0	0	0	3	1	0			
1	26	1	6	1	2	0	0	0	0	0	0	0	0	1	1	2	2	1	6	3	1
0	21	2	2	2	2	0	0	0	0	0	0	0	0	0	0	1	2	1			
0	48	1	3	2	2	0	0	0	0	0	0	0	0	0	0	2	2	1			
0	28	1	4	1	1	0	0	0	0	0	0	0	0	0	0	2	2	0			
0	46	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
0	28	1	2	2	2	0	0	0	0	0	0	0	0	0	0	1	2	1			

	0	27	1	2	2	1	0	0	0	0	0	0	0	0	0	0	2	2	1			
	0	55	1	6	1	2	0	0	0	0	0	0	0	0	1	1	2	3	1			
	0	42	2	4	1	2	0	0	0	0	0	0	0	0	0	0	2	2	1			
	0	35	2	2	2	1	0	0	0	0	0	0	0	0	0	0	2	2	1			
	0	26	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			
	0	19	2	4	1	2	0	0	0	0	0	0	0	0	0	0	3	3	0			
	0	60	1	2	3	2	1	0	0	1	0	0	0	0	0	1	3	1	1			
	1	57	1	1	1	1	0	0	0	0	0	0	0	0	0	0	2	3	1	6	3	0
	1	45	1	3	3	2	1	0	0	1	0	1	0	0	1	1	3	2	1	3	3	4
	0	29	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	29	2	1	1	1	0	0	0	0	0	0	0	0	0	0	1	2	1			
	0	36	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	0	50	1	2	2	2	0	0	0	0	0	0	0	0	0	0	2	1	1			
	0	53	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	30	2	2	3	1	0	0	0	0	0	0	0	0	0	1	2	2	1			
	0	43	1	2	2	1	0	0	0	0	0	0	0	0	0	1	1	2	1			
	0	52	1	4	1	2	0	1	0	0	0	0	0	0	0	0	3	2	1			
	0	29	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			
	0	38	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	1	0			
	0	34	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	0	45	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	1	0			
	0	50	1	4	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	35	1	5	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			

	'OUND	AGE	SEX	SURG DONE	TYPE	NATURE	RISK FACTORS									PRE-OP ANTI-BIOTICS	PER-OP			INFECTED CA		
							GENERAL					LOCAL							ANTI-	DAY OF		
							AN	DM	TB	MAL	IM-SP	UTI	URI	LRI	FCS		DURTN	D/BY	BIOTICS	DETN	METHOD	ORGAN
	0	61	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	40	1	2	2	1	1	1	0	0	0	1	0	0	0	0	1	1	1			
	0	43	2	2	2	2	0	1	0	0	0	1	0	0	0	1	3	1	1			
	0	26	1	2	2	1	0	0	0	0	0	0	0	0	0	0	1	2	1			
	0	23	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			
	0	57	2	5	3	1	0	0	0	0	0	1	0	0	1	1	2	2	1			
	0	33	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	1	75	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0	8	3	1
	0	39	1	3	2	2	0	0	0	0	0	0	0	0	0	1	2	2	1			
	0	52	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	0	23	1	3	2	1	0	0	0	0	0	0	0	0	0	0	2	2	1			
	0	40	1	1	3	1	0	0	0	0	0	0	0	0	0	1	2	2	1			
	1	50	1	2	1	2	0	0	0	0	0	0	0	0	0	0	2	3	1	3	3	1
	0	18	1	2	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
	0	22	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			
	1	58	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0	4	1	
	0	38	1	2	2	2	1	0	0	0	0	0	0	0	0	1	3	1	1			
	0	60	2	6	1	2	0	0	0	1	0	0	0	0	0	1	3	2	0			
	0	70	1	1	1	2	0	0	0	0	0	0	0	0	0	0	3	2	1			
	0	21	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	1			
	0	25	1	1	1	2	0	0	0	0	0	0	00	0	0	0	3	1	1			
	0	55	1	2	3	1	0	0	0	0	0	0	0	0	0	1	3	2	1			
	0	35	1	2	2	2	0	0	0	0	0	0	0	0	0	0	3	2	1			
	0	32	1	2	1	2	0	0	0	0	0	0	0	0	0	1	3	1	1			
	0	42	2	4	1	2	0	0	0	0	0	0	0	0	0	0	3	2	0			
	0	32	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
	0	21	1	3	1	2	0	0	0	0	0	0	0	0	0	0	2	1	0			
	0	32	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	1	0			
	0	60	2	2	2	2	1	0	0	1	0	0	0	1	0	1	3	1	1			
	0	40	1	1	1	2	0	0	0	0	0	0	0	0	0	0	3	2	0			

	0	23	2	6	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0				
	0	33	2	6	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0				
	0	19	1	2	2	2	0	0	0	0	0	0	0	0	0	0	2	2	1				
	1	29	2	2	3	1	0	0	0	0	0	0	0	0	0	1	2	2	1	5	1		

'OUND	AGE	SEX	SURG DONE	TYPE	NATURE	RISK FACTORS									PRE-OP ANTI-BIOTICS	PER-OP			INFECTED C/		
						GENERAL					LOCAL							ANTI-	DAY OF		
						AN	DM	TB	MAL	IM-SP	UTI	URI	LRI	FCS		DURTN	D/BY	BIOTICS	DETN	METHOD	ORGAN
0	29	2	4	1	2	0	0	0	0	0	0	0	0	0	0	3	3	0			
0	32	2	4	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
0	20	1	5	1	2	0	0	0	0	0	0	0	0	0	1	2	3	0			
0	20	1	3	2	1	0	0	0	0	0	0	0	0	0	0	1	3	1			
0	33	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
0	45	1	4	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
0	62	1	1	1	2	00	0	0	0	0	0	0	0	0	0	1	2	0			
1	42	2	2	2	1	0	0	0	0	0	0	0	1	0	1	3	1	1	4	3	2
0	20	1	3	2	2	0	0	0	0	0	0	0	0	0	1	3	2	1			
0	38	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
0	34	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
0	39	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
0	20	1	2	2	2	1	0	0	0	0	0	0	0	0	1	3	1	0			
0	16	1	2	3	1	0	0	0	0	0	0	0	0	0	1	2	3	1			
0	63	1	1	1	2	0	0	0	0	0	0	0	0	0	0	3	1	1			
0	60	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
0	56	2	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
0	20	2	2	2	1	0	0	0	0	0	0	0	0	0	0	2	3	1			
1	24	1	2	3	1	0	0	0	0	0	0	0	0	0	1	1	3	1	7	3	2
0	38	1	2	2	2	0	0	0	0	0	0	0	0	0	1	2	1	0			
0	27	1	1	1	2	0	0	0	0	0	0	0	1	0	1	2	3	1			
0	53	1	2	2	2	1	0	0	0	0	0	0	0	0	0	2	2	1			
0	29	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
0	25	1	2	2	2	0	0	0	0	0	0	0	0	0	0	3	3	1			
0	65	1	1	1	2	0	0	0	0	0	1	0	0	0	0	1	2	0			
0	60	1	2	2	2	1	0	0	0	0	0	0	0	0	1	3	1	1			
0	49	1	1	1	2	1	0	0	0	0	0	0	0	0	0	1	1	0			
0	18	1	2	2	1	0	0	0	0	0	0	0	0	0	1	1	2	1			
0	40	1	4	1	2	0	0	0	0	0	0	0	0	0	0	3	2	0			
0	52	1	2	2	2	0	0	0	0	0	0	0	0	0	1	3	2	0			
0	18	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	4	0			
0	40	2	4	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
0	18	2	2	2	1	0	0	0	0	0	0	0	0	0	1	1	2	1			
0	32	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			

'OUND	AGE	SEX	SURG DONE	TYPE	NATURE	RISK FACTORS									PRE-OP ANTI-BIOTICS	PER-OP			INFECTED C/		
						GENERAL					LOCAL							ANTI-	DAY OF		
						AN	DM	TB	MAL	IM-SP	UTI	URI	LRI	FCS		DURTN	D/BY	BIOTICS	DETN	METHOD	ORGAN
1	25	1	2	3	1	0	0	0	0	0	1	0	1	1	1	2	2	1	2	3	2
0	20	1	2	2	2	0	0	0	0	0	0	0	0	0	0	1	3	1			
1	50	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0	4	1	
1	34	1	3	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0	3	3	1
0	29	2	3	3	1	0	0	0	0	0	0	0	0	0	1	3	2	1			
0	18	1	2	2	1	0	0	0	0	0	0	0	0	0	0	1	2	1			
0	70	1	1	1	2	1	0	0	0	0	0	0	0	0	0	2	2	0			
0	51	2	2	2	2	0	0	1	0	0	0	0	0	0	1	3	2	1			
0	19	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			
0	38	1	2	2	2	1	0	0	0	0	0	0	0	0	1	2	1	1			

	0	31	2	4	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	21	2	2	3	1	1	0	0	0	0	0	0	0	0	1	3	1	1			
	0	59	1	3	2	2	0	1	0	0	0	0	0	0	0	1	3	2	1			
	0	44	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	1	0			
	0	35	1	2	2	2	0	1	0	0	0	0	0	0	0	1	3	2	0			
	0	62	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	0	19	1	2	3	1	1	0	0	0	0	0	0	0	0	1	3	1	1			
	0	42	1	1	1	2	0	0	0	0	0	0	0	0	0	0	3	3	0			
	0	65	1	2	2	2	1	0	0	1	0	0	0	0	0	1	3	2	1			
	0	40	1	4	1	2	0	0	0	0	0	0	0	0	0	0	3	1	0			
	0	24	1	2	3	1	0	0	0	0	0	0	0	0	0	1	2	2	0			
	0	26	1	2	3	1	0	0	0	0	0	0	0	0	0	1	2	1	0			
	0	32	1	2	1	2	1	0	0	0	0	0	0	0	0	1	3	1	1			
	0	19	1	2	3	1	0	0	0	0	0	0	0	0	0	1	2	2	1			
	0	18	2	2	3	1	0	0	0	0	0	0	0	0	0	0	1	2	1			
	1	24	1	6	1	2	0	0	0	0	0	0	0	0	1	1	2	2	1	4	3	3
	0	28	2	2	3	1	0	0	0	0	0	0	0	0	0	0	1	2	1			
	0	18	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	0	52	2	4	1	2	0	0	0	1	0	0	0	0	0	1	3	1	0			
	0	27	1	2	3	1	0	0	0	0	0	0	0	1	0	1	3	2	1			
	0	19	2	6	3	2	1	0	1	0	0	0	0	1	0	1	2	2	1			
	0	44	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	30	1	2	3	1	0	0	0	0	0	0	0	0	0	1	2	3	1			
	0	22	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			

	OUND	AGE	SEX	SURG DONE	TYPE	NATURE	RISK FACTORS									PRE-OP ANTI-BIOTICS	PER-OP			INFECTED CA		
							GENERAL					LOCAL							ANTI-	DAY OF		
							AN	DM	TB	MAL	IM-SP	UTI	URI	LRI	FCS		DURTN	D/BY	BIOTICS	DETN	METHOD	ORGAN
	0	36	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	0	23	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	0	21	1	2	3	1	0	0	0	0	0	0	0	0	0	0	2	3	1			
	0	25	1	2	1	1	0	0	0	0	0	0	0	0	0	1	2	2	0			
	0	32	1	2	3	1	0	0	0	0	0	0	0	0	0	1	2	3	0			
	0	45	1	2	3	1	0	0	0	0	0	0	0	0	0	1	2	3	1			
	0	21	1	2	3	1	1	0	0	0	0	0	0	0	0	1	3	1	1			
	0	65	1	2	2	2	0	0	0	0	0	0	0	0	0	1	3	3	0			
	0	44	1	2	2	2	1	0	0	0	0	0	0	0	0	1	3	2	1			
	0	39	1	1	1	2	0	1	0	0	0	0	0	0	0	1	2	3	0			
	0	34	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
	0	45	1	6	1	2	0	0	0	0	0	0	0	0	1	1	2	2	0			
	0	37	1	1	1	2	0	1	0	0	0	0	0	0	0	1	2	2	0			
	0	18	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	0	31	1	5	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	45	1	2	2	2	0	0	0	0	0	0	0	0	0	1	2	2	0			
	0	75	1	1	1	2	0	0	0	0	0	1	0	1	0	1	2	2	1			
	0	40	2	6	1	2	1	0	0	1	0	0	0	0	0	1	3	2	0			
	0	35	2	2	3	1	0	0	0	0	0	0	0	0	0	1	2	3	1			
	0	41	1	2	2	2	1	0	0	1	0	0	0	0	0	1	2	2	1			
	0	32	1	2	2	2	1	0	0	0	0	0	0	0	0	0	3	3	1			
	0	45	2	4	1	2	0	0	0	0	0	0	0	0	0	0	3	3	0			
	0	16	1	2	3	1	0	0	0	0	0	0	0	0	0	0	2	3	1			
	0	27	1	2	1	1	0	0	0	0	0	0	0	0	0	1	1	2	0			
	0	18	1	6	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	28	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
	0	24	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	4	0			
	0	42	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	1	47	1	3	3	1	1	1	0	0	0	1	0	0	0	1	3	1	1	3	3	2

	0	67	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
	0	21	1	2	2	2	0	0	0	0	0	0	0	0	0	1	3	2	0			
	0	21	2	3	3	2	1	0	0	0	0	0	0	0	0	1	2	1	1			
	0	55	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
	0	40	2	2	2	2	0	0	0	0	0	0	0	1	0	1	3	3	0			

	OUND	AGE	SEX	SURG DONE	TYPE	NATURE	RISK FACTORS									PRE-OP ANTI-BIOTICS	PER-OP			INFECTED CA		
							GENERAL					LOCAL							ANTI-	DAY OF		
							AN	DM	TB	MAL	IM-SP	UTI	URI	LRI	FCS		DURTN	D/BY	BIOTICS	DETN	METHOD	ORGAN
	0	16	1	2	1	1	0	0	0	0	0	0	0	0	0	0	2	2	1			
	0	65	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			
	0	60	1	2	2	2	0	0	0	0	0	0	0	1	0	1	3	3	0			
	1	67	1	3	1	2	0	0	0	0	0	0	0	0	0	0	2	4	0	5	3	5
	0	24	1	3	1	2	0	0	0	0	0	0	0	0	0	0	2	4	1			
	0	59	1	5	3	1	1	1	0	0	0	0	0	0	1	1	2	3	1			
	0	47	2	2	2	2	0	0	0	0	0	0	0	1	0	1	2	1	1			
	1	21	1	6	1	2	0	0	0	0	0	0	0	0	0	0	2	2	1	6	3	1
	0	55	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	34	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
	0	30	2	1	1	2	0	0	0	0	0	0	0	0	0	0	3	2	1			
	0	40	2	1	1	2	0	0	0	0	0	0	0	0	0	0	3	2	1			
	0	35	1	2	2	2	0	0	0	0	0	0	0	0	0	1	2	2	0			
	0	35	1	2	2	2	0	0	0	0	0	0	0	0	0	1	3	2	1			
	0	16	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	19	2	4	1	2	0	0	0	0	0	0	0	0	0	0	3	2	1			
	0	48	1	2	2	2	0	0	0	0	0	0	0	0	0	1	3	1	1			
	0	16	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			
	0	24	1	2	3	1	0	0	0	0	0	0	0	0	0	1	3	2	1			
	0	30	1	1	1	2	1	0	0	0	0	0	0	0	0	0	3	2	1			
	0	18	2	2	2	2	0	0	0	0	0	0	0	0	0	1	1	3	1			
	0	25	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0			
	0	50	1	3	1	2	0	0	0	0	0	0	0	0	0	0	2	2	0			
	0	35	1	2	2	2	0	0	0	0	0	0	0	0	0	1	3	2	0			
	0	21	1	2	2	2	0	0	0	0	0	0	0	0	0	0	1	2	1			
	0	21	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	3	0			
	0	39	1	2	2	2	0	0	0	0	0	0	0	0	0	1	3	2	0			
	0	30	1	2	2	2	0	0	0	0	0	0	0	0	0	0	2	3	1			
	0	31	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0			
	0	47	1	5	1	2	0	0	0	0	0	0	0	0	0	0	2	2	1			
	1	35	1	6	1	2	0	0	0	0	0	0	0	0	1	1	2	2	1	5	3	2
	0	52	1	2	2	2	1	0	0	0	0	0	0	1	0	1	3	1	1			
	0	60	1	3	1	2	0	0	0	0	0	0	0	0	0	0	1	4	0			
	1	67	1	1	1	2	0	0	0	0	0	0	0	1	0	0	2	2	1	5	3	3

	OUND	AGE	SEX	SURG DONE	TYPE	NATURE	RISK FACTORS									PRE-OP ANTI-BIOTICS	PER-OP			INFECTED CA		
							GENERAL					LOCAL							ANTI-	DAY OF		
							AN	DM	TB	MAL	IM-	UTI	URI	LRI	FCS		DURTN	D/BY	BIOTICS	DETN	METHOD	ORGAN

											SP												
	0	25	2	2	2	2	0	0	0	0	0	1	0	0	0	0	2	2	1				
	0	28	1	2	1	2	0	0	0	0	0	0	0	0	0	1	3	2	0				
	0	60	1	5	1	2	0	0	0	1	0	0	0	0	0	0	3	2	1				
	0	48	1	1	1	2	0	0	0	0	0	0	0	0	0	0	2	3	0				
	1	61	1	2	2	2	1	0	0	0	0	0	0	1	0	1	3	2	1	6	3	1	
	0	67	2	2	3	2	1	0	0	1	0	0	0	0	0	1	3	1	1				
	0	57	1	1	1	2	0	0	0	0	0	0	0	0	0	0	1	2	0				

APPENDIX

PROFORMA : WOUND – INFECTION

INFECTED / NOT INFCTED

NAME : AGE :

SEX :

ADDRESS : OCCUPATION :

HOSPITAL NO : SOCIO-ECONOMIC

STATUS :

CLINICAL SUMMARY AND DIAGNOSIS :

INVESTIGATIONS :

Hob% : Blood Sugar :

Urine – Others :

RISK FACTORS :

GENERAL	YES	NO
ANEMIA	( )	( )
DIABETES	( )	( )
TUBERCULOSIS	( )	( )
MALIGNANCY	( )	( )
IMMUNOSUPPRESSION	( )	( )

SPECIFIC / LOCAL	YES	NO
UTI	( )	( )
URI	( )	( )
LRI	( )	( )
FOCUS OF INFECTION	( )	( )

SURGERY PROPOSED

SURGERY PERFORMED

TYPE OF SURGERY:

CLEAN	( )
CLEAN-CONTAMINATED	( )
CONTAMINATED	( )

NATURE OF SURGERY:
- ELECTIVE ( )
- EMERGENCY ( )

PRE-OPERATIVE ANTIBIOTICS:
- GIVEN ( )
- NOT GIVEN ( )

PER-OPERATIVE
- DURATION OF SURGERY:
  - <1 Hrs. ( )
  - 1-2 Hrs. ( )
  - >2 Hrs. ( )
- PERFORMED BY:
  - CHIEFS ( )
  - ASST. PROFS. ( )
  - TRAINEES ( )
  - INTERNS ( )
- ANTIBIOTICS:
  - USED ( )
  - NOT USED ( )
- POST OPERATIVE:
  - INFECTED ( )
  - NOT INFECTED ( )

FOR “INFECTED” CASES ONLY

DAY OF DETECTION:

METHOD OF DETECTION:
- CLINICAL ( )
- MICROBIOLOGICAL ( )
- BOTH ( )

ORGANISMS GROWN IN CULTURES:

SENSITIVITY PATTERN TO ANTIBIOTICS:

OUTCOME:
- RESOLVED ( )
- NOT RESOLVED ( )

NAME

CODE

DONE BY
- CHIEFS
  1
- ASST.PROFF
  2

TRAINEES
3
INTERNS
4
ANTIBOITICS
USED
1
NOT-USED
0
POST-OPERATIVE
METHOD OF DETECTION
CLINICAL
1
MICROBIOLOGICAL
2
CLINICAL & MICROBIOLOGICAL
3
OUTCOME
RESOLVED
1
NOT-RESOVED
0
ORGANISM GROWN IN CULTURE
NO GROWTH
0
STAPHLOCOCCUS AND STREPTOCOCCUS SPECIES
1
ESCHERICHIA AND KLEBSIELLA SPECIES
2
PSEUDOMONAS AEURIGINOSA
3
CITROBACTER DIVERSIS
4
OTHERS
5

*CODING

NAME
CODE
WOUND
INFECTED
1
NOTINFECTED
0
SEX

MALE
1
FEMALE
2

SURGERY DONE

ABDOMINAL WALL SURGERIES
1
i inguinal Hernia
ii Incisional Hernia repair
iii

LAPAROTOMIES
2
i GJ – Vagotomy
ii Cholecystectomy
iii Appendicectomy
iv Resection Anastamoses
v Perforation Closure
vi Retropertioneal Tumor Excision

GENITO – URINARY SURGERY
3
i Hydrocelectomy
ii Orchidopexy / orchidectomy
iii Carcinoma Penis – Partial penectomy/
Total penectomy with Urethrostomy

HEAD & NECK SURGERY
4
i Thyroidectomies
ii Salivary Gland Tumor – Excision

NAME
CODE

UPPER & LOWER LIMB SURGERY
5
i Amputations
ii Surgery for Varicose Veins

- Trendelenberg Operation
- Lintons Procedure
- Auvlsion & Ligation
-

OTHERS

i Lumbar Sympathectomy
6
ii Breast Surgeries

TYPE OF SURGERY

CLEAN
1
CLEAN-CONTAMINATED
2
CONTAMINATED

3

NATURE OF SURGERY

EMERGENCY
1
ELECTIVE

2

RISK FACTORS

PRESENT
1
NOT-PRESENT

0

PRE-OPERATIVE ANTIBIOTICS

USED
1
NOT-USED

0

PER-OPERATIVE

DURATION

<1 HOUR
1

1-2 HOURS
2
>2 HOURS
3